YOUR GUIDE TO THE NEXT GENERATION OF PDM

How Cloud, Analytics, Mobile and Social are Changing Product Data Management

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Introduction: 
Product Data Management at a Fork in the Road

Today, product development technology stands at a fork in the road between status quo and strategic serendipity. The status quo is rooted in desktop processes, central storage, hierarchical workflows, and data access. The path to strategic serendipity is paved by new interrelationships of four existing technologies.

You are likely familiar with the four:

- Cloud
- Analytics (AKA “big data”)
- Mobile
- Social

The smartphone in your pocket is the best example of how these four technologies—which we refer to by their acronym CAMS—used together can transform long-standing practices. Many engineers and product designers want to take advantage of the same mobile, social, and cloud technologies in their work that they use at home.

Take, for example, a complex body of data like a video. It doesn’t seem right that one can record a video on a smartphone, store it in a cloud-based hosting service and watch that service use facial recognition technology to identify friends. Along with other videos, it can be sorted by the encoded GPS coordinates and sent to one or more social media sites where friends and strangers can view it, edit it, and pass it along. Meanwhile back at work that same fluid, creative facility with product development content is completely lacking.

Product development is based on a set of software tools and methods to automate existing processes. This automation has improved each of the six steps of product development:

- Concept engineering: translating customer requirements into a product idea
- Product design: design, engineering, and documentation of the product idea
- Digital validation: simulation and analysis of a virtual version of the product
Manufacturing and assembly: using physical and digital tools to build the product

Physical test and validation: Final testing before shipment

Ongoing engineering: using downstream feedback for continual improvement or to design the next generation

Unfortunately, the improvements have done little to reinvent the process as a whole. *It is a case of paper on glass—processes originally done at a desk on paper are now done at a desk on a computer.* Each step in the product development cycle is automated, but there is little if any synergy gained beyond automation of the individual steps.

There is one product development discipline taking advantage of these new technologies: software engineering. Workflow has changed drastically in software development in recent years. There is reuse, interaction, collaboration, open access, and gathering knowledge from many sources. These new developments have created new product development velocity in the software industry.

Here, we contend a similar workflow revolution can come to physical product development—if the individuals, companies, and supply chains involved will embrace the new.

**The New Pillars of Product Development Technology**

It is common in software to call a set of related technologies a stack. For example, the World Wide Web is based on LAMP: Linux, Apache, MySQL, and Perl (or Python or PHP). All four are required, with each technology foundational to the one following. CAMS technologies do not share such defining inter-dependencies. A better visual analogy than a “stack” is a “pillar”. One pillar is useful, but limited. When all four pillars are in place and of the same height, they become capable of holding great weight.

It is possible to deploy cloud, analytics, mobile, and social independently as tactical extensions of an existing product development environment, but that would be like adding a pillar to a building after the roof is already up. The CAMS technologies are capable of replacing the building entirely, transforming a workflow born of physical processes to one created from scratch to be digital.
In both consumer and enterprise operations new CAMS–based products are transforming processes and disrupting industries, not simply providing additional automation of existing tasks. Two quick examples:

- Nokia and Motorola once owned the mobile phone market, but the smartphone revolution almost destroyed both companies.
- Kodak invented digital photography, but failed to innovate further and could not see past its historic connection to film.

Now CAMS technologies are making their combined presence felt in product development. Let’s look more closely at each technology.

**Cloud Computing: Infinite Computation and Infinite Storage on Demand**

Cloud computing is a network computing model; computation and storage are on a server, not a local device. Unlike previous generations of remote access computing, cloud computing uses a process called virtualization, which re-allocate computer resources so that many servers run one task, or one server runs many tasks in parallel. The result is delivery of custom computing experiences on-demand.

The on-demand aspect of cloud computing is key; it changes both the economics of computer use and the ability to optimize workflow. With cloud computing, the expense of owning and operating a high–performance computing environment can become an occasional rental. Computation and storage become utilities, available for use on demand. Complex software products that in the past only ran on a workstation can now run from the cloud for use on a tablet.

The immediate availability of substantial computer power—when combined with the other CAMS technologies—creates opportunities to replace the discrete steps of product development with a more fluid and dynamic process.

Cloud computing has opened the door to “as a service” delivery models; the best known is Software as a Service (SaaS). Software is not purchased but used on a subscription basis; not installed locally but reached as needed from a cloud–based server. Once limited to business operations like human resources and
customer relationship management, the SaaS model is invading the technical software industries, including product development.

Analytics: Put Your Data in a River, Not a Vault

In many companies, the Windows file manager is the most complicated data management tool in use. Tech-Clarity senior analyst Jim Brown says many data management solutions “are out of reach ... due to cost and lack of IT resources.” Companies of all sizes have significant problems keeping track of versions, enforcing standards, and sending the right information to the right place. Attend any CAD user conference, and compare the number of attendees in sessions on modeling tips and tricks against those attending sessions on product data management. You will quickly see how few engineers are attracted to the data housekeeping details.

In CAMS, Analytics (big data and its use) is not a technology per se but the company’s nourishing water. As such, it is largely circulated by the other elements. Most business operations turn their data into visualizations for increased insight. Product development visualizations are data. The geometry in drawings and models are precise representations and the embodied information drives a wide range of downstream processes. In addition to the geometric information, there is metadata—data about data (BOMs, tolerances, versioning, sheet sets, simulations, engineering change notices, tech notes, and much more).

All that data quickly adds up to management headaches, even in the smallest organizations. Data is useless if it not accessible, yet most people who create the data—engineers and designers—are not thrilled about the work it takes to make all that information useful to others. Today most people think of a “vault” when they think of data. A CAMS view of data/analytics is more like a “river.” In a CAMS analysis of product data management, Cloud, Mobile, and Social technologies unite to unleash new value from your big data—CAD and otherwise—by circulating it in ways not previously possible.

Mobile: The Productivity Revolution in Your Pocket

In years past, desktop computing set the pace for innovation. Today, mobile devices drive innovation. In 2011 one CAD company CEO admitted to me his company felt “pushed” by the rapid innovation in mobile technology and high customer demand for mobile products. But the demand only grows as consumers
find high utility in mobile devices and want their professional computer tools to be similarly flexible and innovative.

**Mobile is the most challenging CAMS technology to the product development status quo.** The current path from idea to shipping product is very much an “under one roof” production mindset. Existing product development technology mirrors the organization: hierarchical and iterative, organizing tasks to be serial and local, not parallel and distributed. By comparison, the other major user of CAD technology—construction—has always known a distributed workflow based on temporary alignments and competing hierarchies. A quick survey of CAD–related mobile apps reveals many more products suited to construction than to product development.

**Social: Automating Relationships as a Strategic Asset**

The formal and informal communications between product development team members is filled with valuable information. But until social technology came along, it has been difficult to capture this information and re-use it as a strategic asset.

**Social technology can turn the informal flow of information into usable data.** It captures and stores communication, and mediates interactions between individuals and groups. Social technology encourages and manages collaborative behavior through automation.

If the conversation below sounds familiar, then the strategic value of relationships and communications already makes sense to you:

“Who is ‘Joe W.’?”

“Oh, that’s Joe Winooski in the Moline office.”

“Well, his fan assembly model has lousy documentation, and I need it for what I’m working on.”

“Joe doesn’t use CAD, some intern probably drew that.”

“Doesn’t use CAD… what’s with that?”

“Joe’s like 66 years old and the company doesn’t want him to retire because he knows more about our products than anybody but he won’t touch a computer.”

Most product development teams rely on email as their “social media” solution, but there are inherent inefficiencies. The flow of email is separate from the engineering process. If files are
attached to messages, there are immediate problems with version control and security.

Some existing product data management (PDM) products offer communications utilities, but they are often not used. The process is viewed as artificial and shunned by engineers. Some third-party utilities link messages inside the PDM to systems not commonly used by the product team, such as Supply Chain Management (SCM) or Manufacturing Execution Systems (MES) software.

Anyone who has used Facebook, Twitter, LinkedIn, or even Pinterest knows how social technology can be engaging and valued in one’s personal life. Product development needs social technology that is engaging yet integral to the process.

It may be too late to capture Joe’s wealth of knowledge, but going forward such information should be considered a primary data asset to be collected right along with the Bill of Materials. Social media succeeds when it automates on-demand access to relationship data.

**Untethered Product Data Management**

The phrase “collaborative product data management” was in vogue around the turn of the 21st Century among the leading CAD/PLM firms. A leading industry advisory firm was once known as CPDA, Collaborative Product Data Associates. But the term fell out of favor. Vendors pushed PLM to be the complete solution for product data among large manufacturers, and it became increasingly obvious less comprehensive PDM products were still too complex to catch on with smaller workgroups. Mainstream CAD vendors continued creating PDM products, like Autodesk Vault and SolidWorks Enterprise PDM. In our off-the-record conversations over the years, developers would confess sales were always below expectations. Most of the time small design and engineering workgroups continued to share data with email and manage it at the file level.

Today technology and expectations are changing rapidly. Engineers want to take advantage of CAMS technology in their work the same way they do in their personal life. Venture capital firm Greylock Partners claims product development teams are looking for new software to match today’s expectations. “Engineering and Manufacturing Managers are looking for different ways to help individual engineers become more productive, and have internal and external supply chain teams work together. The key for this transition is creating clear communication and process around the workflow. The best way to
manage this is through software that is designed for the new environment.” The word “collaboration” is being rehabilitated as this newest wave of technology is embraced.

Consilia Vektor calls this new approach untethered design, which we define as the ability to do any product development task from any screen, in any location, at any time, with resources on demand, as part of a collaborative team. The phrases “on demand” and “collaborative” are paramount. Each CAMS element offers an on-demand element that can radically improve product development and allow effective interaction among team members:

- Cloud enables on-demand computation and storage
- Analytics enables on-demand insight
- Mobile enables on-demand access
- Social enables on-demand collaboration

Why untethered? All of these on-demand functions can happen without boundaries. The centralization of human and computer resources in product development is a vestigial artifact of a bygone era. This is not an argument about the economic or social effects of outsourcing or offshoring. Untethered design transforms a closed process into an open one. It doesn’t matter if every participant lives in the same city or they are scattered around the globe. The move to CAMS-based product development will reap the same benefits achieved in open software development: rapid iteration, access to talent, lower development costs, increased quality, greater insight into processes, and much more.

Solving the Five PDM Pain Points

There are five distinct product data management pain points. Every PDM product, to some degree, addresses these issues:

**Finding data:** Once created, product data needs to be easily accessible. Creating directories and subdirectories quickly becomes complicated, as newer drawings and models bury older ones. The data is not only in CAD but also in text documents and spreadsheets, further complicating the ability to quickly find it later.

**Reusing data:** The parts catalog industry exists because many pieces of new products can be created from standard parts. Internally, once a new item is created, reusing it should be a high priority.
Sharing data: Once product development involves more than one person, how information is exchanged becomes either a benefit or a bottleneck.

Controlling data: Product data is sensitive, one of any company’s most important strategic assets. Any plan for sharing data must put security first.

Extending data: The value of product data grows when it becomes useful beyond engineering and manufacturing. A complete PDM system must take into account those who use but do not create product data.

Existing PDM systems were designed to support a fragmented organization where words like “stages” and “silos” are apt descriptions. The idea is to protect information, but too often the protection becomes a wall that prevents meaningful interaction.

The rise of CAMS on-demand technologies, with their ease of use and flexible approach to utility, can address the pain points more efficiently than today’s methods:

Finding data: Visual access to drawings and models from any device makes it easy to locate the right part or assembly. Search trumps Sort as a primary method of locating information.

Reusing data: Data reuse is a function of data access. When product information is easily reached using a tablet or cellphone, it is more likely to be reused.

Sharing data: Access to ideas is the lifeblood of innovation, and sharing is human nature. The use of social technology supports communicating and keeps the discussions accessible for future use. PDM software should make the process of sharing information within a team as simple as a flick or a drag-and-drop.

Controlling data: Maintaining control of product data is not antithetical to open access. In an on-demand environment the control of data is about making sure all the right people have wide open access (or as much as they need without being overwhelmed) and none of the wrong people have any access at all.

Extending data: Cloud storage makes CAD data accessible as widely as is necessary for the team, and opens up new ways to share with customers as well as development team members.
The New Agenda for Product Data Management

The workflow in most engineering organizations is more about systems of record than vehicles of innovation. There are hundreds of thousands of designers and engineers who look at existing PLM and PDM products and see too much administrative overhead, too many institutional restrictions, and high cost. They want the creative utility and flexibility they experience using mobile devices and social media. They don’t buy into the FUD (Fear, Uncertainty, Doubt) traditional vendors use to scare people away from cloud and social technologies.

CAMS allows product development to become a system of engagement, in which everyone can efficiently contribute to the process and to the outcome. Taking full advantage of CAMS technology is essential to making progress in the digital economy. Methods defined in an earlier era need to be carefully re-examined in the light of what can be accomplished today.

Going forward, there is a new agenda for PDM, an agenda based in openness and on-demand utility. We see five emerging principles guiding this new agenda.

**Visual first**

As we said above, CAD models and drawings are not illustrations of data, they are the data. Historically CAD data has been too complex and too proprietary to easily share. Any time a model or drawing is converted, a break in the information flow occurs. Any notes or changes to the converted file do not connect back to the original. Keeping all the data in the original format is an important part of opening up the information flow.

When CAD models are accessed from a cloud system, enough computer power is available to deliver models with full fidelity. Manufacturing engineers, brand managers, and other team members can all have the data they needs, whether it is a photorealistic view or the PMI data. Everyone is viewing the same data source, not one-off conversions no longer connected to the original. Resisting the tendency to reduce CAD model information to rows and columns of data keeps it more useful for more people. Continued access to the original model without conversion creates a more dynamic workflow.
Design anywhere

It does not take enterprise software and custom development to allow Joe in Genoa and Frank in Frankfurt to work with Allison in Alabama on a great new idea for a mountain bike gear system. They don’t need a central office, a good internet connection, or a shared repository for their CAD models. The social media of their choice facilitate their collaboration.

Manufacturers of all sizes are discovering the value of distributed product development, defined by the Product and Development Management Association (PDMA) as:

“The separation and optimization of activities performed during a single product development process (i.e., product ideation, development and launch) across multiple geographic locations. These locations may be within a single corporate entity, within subsidiaries or involve the use of third parties.”

Engineering analysis, simulation, and rendering are all available from cloud-based solutions. While desktop CAD will be the primary design tool, many of the elements of product design are now available in mobile solutions, or the desktop product is accessible from a mobile device using remote control software.

Open engineering

When some in manufacturing hear the term “open engineering” they think it means the same as open source software development – no claim of ownership for product information and anybody can take your information and use it for their own purposes. Open engineering is different. It is about taking advantage of web-based communities, knowledge, and tools to accelerate design and manufacturing processes.

The story of GE’s new jet engine bracket has been told so many times it is becoming a legend. The point is, GE did not know M. Arie Kurniawan of Indonesia or any of the other 700 engineers from 56 countries who submitted a design in a contest hosted on GrabCAD. Instead, GE used the principles of open engineering to discover an innovative design for a new loading bracket built using 3D printing, a design the in-house engineers had not considered. As GE’s Steve Liguori said after the contest ended: “By applying GE’s scale and expertise to open innovation, we can continue to grow the ecosystem of designers, engineers, materials scientists, and other partners to redefine the industry and drive
Another GE executive, Alex Tapper, was more pointed in his comment: “The writing is on the wall. Evolve quickly. Evolve or you will be disrupted by someone you don’t even see coming.”

**Customers as collaborators, clients as partners**

The same tools that allow distributed teams to work together can be extended. CAMS makes it possible to ask customers for input on new products, even as the design work is underway. The ability to show a potential customer a design by sending a web link is simple and empowering. If that web-based environment can not only show the model, but keep track of the discussion, render it in a variety of colors and styles, and run engineering simulations it broadens the empowerment and increases the speed at which design can interact with clients and potential customers.

The complex 3D models at the heart of most product development today have their roots in a technology that required dedicated hardware and a linear workflow. Today CAMS technology will not only liberate 3D models by giving them a lightness of delivery to anyone anywhere, it also supports the model with new ways to study, store, track, and reuse the metadata generated by the process. Disperse teams can make faster decisions, often in a single collaborative session instead of several review rounds.

**The End of “Good/Cheap/Fast: Pick Two”**

In the early days of personal computers, there was a saying about the buying process: “Good, cheap, fast; pick any two.” For product design the equivalent has always been accurate, fast, and cheap. Any two of the three can be applied to product development, but not all three.

CAMS technology makes all three now possible. Real-time collaboration speeds the design process. On-demand access to CAE tools makes accuracy possible without owning an in-house copy of the right simulation product(s). Because that access to high-end engineering resources can be purchased in brief bursts, development costs can be kept cheap.
Conclusion:
Make the Serendipity Happen

“The first rule of any technology used in a business is that automation applied to an efficient operation will magnify the efficiency. The second is that automation applied to an inefficient operation will magnify the inefficiency.” – Bill Gates

Collaborative workspaces are the new frontier in product development. It is not a formal collaboration style that says: “I did my work, now you do yours.” But instead, it is a new way of working with technology that allows every person to participate when their input can benefit the most and when interaction can be a synergistic force. The key is sharing. Every bit of information about the product needs to be sharable at any state in the process. Anything less is an annoyance and a barrier to productivity.

Cloud, Analytics, Mobile, and Social are the tools to create a new product development process. One that fully embraces on-demand capabilities and the re-imagining and re-energizing of product design and engineering. We are witnessing the early stages of a revolution. Thirty years ago people were excited by what personal computers could accomplish, but few could have guessed how widespread the revolution would be. Product data management is at the beginning of a similar revolution.

The word “serendipity” comes from a story about three princes from a land called Serendip. They were seen as lucky bumbler s who somehow tripped onto great discoveries. The moral behind the story is not about happy accidents, but the state of readiness and wealth of knowledge that makes discovery possible. Today’s Princes of Serendip are those who equip themselves with technology that replaces archaic, hierarchical workflow with an empowering, sharing platform for creativity and efficiency. Today CAMS offers us the ability to create the next generation of PDM.

About Consilia Vektor

Consilia Vektor is a research and consulting service for the technical software industry and related disciplines. Founder and Principal Analyst Randall S. Newton has more than 25 years of experience in computer-aided design technology as a programmer, marketing consultant, journalist, and business analyst. From our base in American Pacific Northwest we roam the world virtually and physically to track and describe the trends shaping the Digital Epoch.